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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/724,938 | 12/01/2003 | Yu-Ting Cheng | YOR920030286US1(8728-659) | 3222 |
| 46069 | 7590 | 05/30/2006 | | |
| F. CHAU & ASSOCIATES, LLC 130 WOODBURY ROAD WOODBURY, NY 11797 | | | EXAMINER HA, NATHAN W | |
| | | | ART UNIT 2814 | PAPER NUMBER |
| DATE MAILED: 05/30/2006 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|------------------------------|--|
| Office Action Summary | Application No. 10/724,938 | Applicant(s) CHENG ET AL. | |
| | Examiner Nathan W. Ha | Art Unit 2814 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 and 22-28 is/are pending in the application.
- 4a) Of the above claim(s) 1-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-18 and 22-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 12-18 and 23-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger (US 2003/0127743, previously cited) in view of Dubin et al. (US 2005/0062169, newly cited, hereinafter, Dubin.)

In regard to claims 12 and 23, in figs. 1-6, Brintzinger discloses a method for forming an interconnection structure for flip-chip attachment of microelectronic device chips to packages, comprising:

forming a barrier layer 2 over a substrate 1;

forming an adhesion layer 3 over the barrier layer;

forming a resist layer 7 over the adhesion layer, the resist layer having an opening that exposes the adhesion layer;

forming first solderable layer 4 over the adhesion layer through the opening the resist layer, wherein the solderable layer is made of copper;

forming a second solderable layer 5 over the copper layer through the opening in the resist layer, fig. 6 shows this feature, wherein the second solderable comprises nickel, see also [0034];

removing the resist layer;

removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion layer and the second solderable layer, fig. 5. It is further noted that a solder bump will be formed on this structure as suggested in paragraph [0034].

Brintzinger further discusses the feature of the solderable layer 6 such for layer conductive bump can be formed thereon. However, he does not expressly show a diffusion barrier layer made of CoWP between the copper layer and the nickel layer.

Dubin, in fig. 4, for example, discloses an analogous device including substrate 405, first solderable layer 415 on the substrate, a diffusion barrier 425, a second solderable 434, and solder ball 410. Dubin further suggests that the diffusion barrier is formed between first and second solderable layer, and specifically on top of the first solderable layer which is made of copper. This arrangement provides an advantage of preventing the diffusion of the materials from layers 435 and 410, or preventing whisker formation. See also paragraphs [0035-0037].

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to further recognize forming a CoWP diffusion barrier on the copper as taught by Dubin in order to take the advantage as mentioned above.

In regard to claims 13 and 28, Brintzinger discloses photoresist layer is formed around the barrier layer, the adhesion layer, the first and second solderable layers and the diffusion barrier layer. Photoresist material is a form of polyimide material.

In regard to claim 14, Brintzinger further discloses that the step forming the barrier layer comprises sputtering. See paragraph [0029].

In regard to claim 15, Brintzinger further discloses wherein the step of forming the adhesion layer comprises sputtering. See paragraph [0029].

In regard to claims 17 and 25, Brintzinger further discloses that the step of forming the diffusion barrier layer comprises electroless deposition. See the discussions in paragraphs [0033-0034].

In regard to claim 24, Brintzinger discloses all of the limitations as mentioned in claims 1 and 23 above and further discloses a method of electrolytic the adhesive layer. See [0029].

In regard to claim 27, Brintzinger further discloses
removing the resist layer after the first solderable layer, the diffusion barrier layer and the second solderable layer are formed; and
removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion barrier layer and the second solderable layer after the resist layer is removed. See figs. 6-7.

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute the barrier layer as taught by Jin in Brintzinger's in order to take the advantage as mentioned above.

In regard to claims 16, 18 and 26, Dubin further discloses that the solderable layers 415 and 435 are made by electroplating method to provide uniform thickness. See also, [0037].

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to use the well known method such electroplating in order to control the thickness of the barrier layer.

3. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger and Dubin as applied to claims 12-18 and 23-28 above, and further in view of Jin et al. (US 2004/0178503, previously cited, hereinafter, Jin.)

In regard to claim 22, the combination Brintzinger and Dubin discloses all of the claimed limitations as mentioned above, except further disclose that the solder ball is formed by solder screening, or printing. However, this method is widely used in semiconductor package where solder paste is screened through a stencil, therefore, results in a solder bump height can be properly controlled. See [0040].

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute use the method as taught by Jin in Brintzinger and Dubin in order to take the advantage as mentioned above.

Response to Arguments

4. Applicant's arguments with respect to claims 12 and 23 have been considered but are moot in view of the new ground(s) of rejection.

5. In regard to the arguments of the restricted claims, Applicants submit that the search is coextensive, therefore, the claims should be examined all together. This is not persuasive since Applicants have not point out that the device is in fact could be made by processes materially different from those of the group II invention as the reason for

the restriction in paper 9/6/05. Therefore, a complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan W. Ha whose telephone number is (571) 272-1707. The examiner can normally be reached on M-TH 8:00-7:00(EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Nathan Ha
May 25, 2006